We claim:

1. A lightning detection system, comprising:

a source of an electrical detection signal representative of an electromagnetic field produced by a lightning discharge;

an analog-to-digital converter, responsive to said electrical detection signal, for producing a digital detection signal;

a digital processor for determining the type of lightning discharge that produced said electromagnetic field based on characteristics of said digital detection signal, said digital processor producing digital data characterizing lightning discharges that are identified;

a data compression component for reducing the amount of data needed to characterize a lightning discharge so as to decrease the time or bandwidth required to transmit data representative of a series of lightning discharges; and

a data transmission component for transmitting said characterizing data over a communications channel.

2. The lightning detection system of claim 1, wherein both said digital processor and said data compression component comprise a programmed digital processor.

3. The lightning detection system of claim 1, wherein said data compression component produces, as data representative of said series of lightning discharges, data representative of the amplitude and data representative of the time of occurrence of the largest amplitude discharge in said series of lightning discharges.

4. The lightning detection system of claim 3, wherein said data compression component further produces, for one or more additional lightning discharges in said series of discharges, data representative of the time of occurrence of each said additional discharge with respect to the time of an adjacent discharge.

5. The lightning detection system of clam 4, wherein said data compression component further produces, for said one or more additional discharges in said series of discharges, data representative of the relative amplitude of each said additional discharge with respect to the amplitude of said largest amplitude discharge.

6. The lightning detection system of claim 5, wherein said data compression component further comprises a data decimation component for synchronously decimating said characterizing data when needed to accommodate the bandwidth of said communications channel.

7. The lightning detection system of claim 6, wherein said data decimation component comprises a component for determining whether the rate of electrical detection signals produced by said source in response to said series of lightning discharges exceeds the data transmission capacity of said communications channel and, in that event, selecting for transmission only data representing those electrical detection signals that occur during a periodically occurring time frame of predetermined length.

8. The lightning detection system of claim 1, further comprising a data decimation component for synchronously decimating said characterizing data when needed to accommodate the bandwidth of said communications channel.

9. The lightning detection system of claim 8, wherein said data decimation component comprises a component for determining whether the rate of electrical detection signals produced by said source in response to said series of lightning discharges exceeds the data transmission capacity of said communications channel and, in that event, selecting for transmission only data representing those electrical detection signals that occur during a periodically occurring time frame of predetermined length.

10. The lightning detection system of claim 1, further comprising a plurality of sources and respective analog-to-digital converters, digital processors, data compression components and data transmission components, and a central processor associated therewith for receiving said characterizing data, said central processor including a discharge correlation component for correlating sets of data representing series of discharges from respective said sources to determine the time and location of one or more discharges.

11. The lightning detection system of claim 10, wherein said sets of data are correlated in time.

12. The lightning detection system of claim 11, wherein two distinct pairs of three said sets of data are operated on by a correlation operator, the time shift corresponding to the peak

correlation value is taken to be the difference in propagation time from a given discharge to the respective sensors which serve as respective sources whose data is correlated, and the two time differences thus found are used to estimate the location of a discharge.

13. The lightning detection system of claim 11, wherein three said sets of data from respective sources are first compared to identify the data corresponding to the highest amplitude discharge represented in each set, the time differences between two distinct pairs of said data representing the highest amplitude discharge is taken to be the difference in propagation time from the highest amplitude discharge to the respective sensors, which serve as respective sources whose data is correlated, and the two time differences thus found are used to estimate the location of the said highest amplitude discharge.

14. The lightning detection system of claim 13, wherein said sets of data are shifted in the time domain so that data representing said highest amplitude discharge in each said set of data are coincident, and the corresponding time interval between adjacent discharges are compared for each set of data to estimate the reliability of the correlation.

15. The lightning detection system of claim 14, wherein said correlation is accepted as reliable where at least one corresponding said time interval from among all said sources agrees to within a predetermined maximum value.

16. The lightning detection system of claim 15, wherein said central processor further includes an optimization component which, when said data sets comprise redundant information

regarding the location or time of occurrence of a discharge, applies an optimization algorithm to determine the optimum time and location pair.

17. The lightning detection system of claim 16, wherein said optimization algorithm employs a least-squares estimation of the optimum time and location pair based on propagation time data from at least four sensors which serve as respective sources.

18. The lightning detection system of claim 10, wherein when said characterizing data includes information about the angle relative to two sensors which serve as respective sources with respect to a discharge, the location of said discharge is initially determined from said angles.

19. The lightning detection system of claim 18, wherein the arrival times of said discharge whose location is determined by said angles at a plurality of sensors which serve as respective sources are estimated from said location, said sets of data from said plurality of sensors are shifted in the time domain by relative differences in said arrival times, and the corresponding time intervals between adjacent discharges are compared for each set of data to estimate the reliability of said correlation.

20. The lightning detection system of claim 19, wherein said correlation is accepted as reliable where at least one corresponding said time interval for all said sensors agrees to within a predetermined maximum value.

21. A lightning detection system, comprising:

an antenna for producing, in response to an electromagnetic field produced by a lightning discharge, an electrical detection signal representative of said field;

an analog-to-digital converter, responsive to said electrical detection signal, for producing a digital detection signal;

a digital processor for determining the type of lightning discharge that produced said electromagnetic field based on characteristics of said digital detection signal, said digital processor producing digital data characterizing lightning discharges that are identified;

a data decimation component for synchronously decimating said characterizing data to reduce the data for transmission; and

a data transmission component for transmitting said decimated characterizing data over a communications channel.

22. The lightning detection system of claim 21, wherein both said digital processor and said data decimation component comprise a programmed digital processor.

23. The lightning detection system of claim 22, wherein said data decimation component comprises a component for determining whether the rate of electrical detection signals produced by said antenna in response to a series of lightning discharges exceeds the data transmission capacity of said communications channel and, in that event, selecting for transmission only data representing those discharges' electrical detection signals that occur during a periodically occurring time frame of predetermined length.

24. A lightning detection system, comprising:

a plurality of sources of data representative of a series of lightning discharges; and

a central analyzer for receiving and analyzing said data representative of a series of lightning discharges, said central analyzer including a discharge correlation component for correlating sets of data representing series of discharges from respective said sources to determine the time or location of one or more discharges.

25. The lightning detection system of claim 24, wherein said sets of data are correlated in time.

26. The lightning detection system of claim 25, wherein two distinct pairs of three said sets of data are operated on by a time correlation operator, the time shift corresponding to the peak correlation value is taken to be the difference in propagation time from a given discharge to the respective sensors which serve as respective sources whose data is correlated, and the two propagation time differences thus found are used to estimate the location of a discharge.

27. The lightning detection system of claim 25, wherein three said sets of data from respective sources are first examined to identify the data corresponding to the highest amplitude discharge represented within each set, the time differences between two distinct pairs of said data representing the highest amplitude discharge is taken to be the difference in propagation time from the highest amplitude discharge to the respective sensors which serve as respective sources

whose data is correlated, and the two propagation time differences thus found are used to estimate the location of the said highest amplitude discharge.

28. The lightning detection system of claim 27, wherein said sets of data are shifted in time so that data representing said highest amplitude discharge in each said set of data are coincident, and the corresponding time intervals between adjacent discharges are compared for each set of data to estimate the reliability of the correlation.

29. The lightning detection system of claim 28 wherein said correlation is accepted as reliable where at least one corresponding said time interval for all said sensors agrees to within a predetermined maximum value.

30. The lightning detection system of claim 24, wherein when said representative data includes information about the angles relative to two sensors which serve as respective sources with respect to a discharge, the location of said discharge is initially determined from said angles.

31. The lightning detection system of claim 30, wherein the arrival times of an electromagnetic field produced by said discharge whose location is determined by said angles at a plurality of sensors which serve as respective sources are estimated from said location, said sets of data from said plurality of sensors are shifted in the time domain by relative differences in said arrival times, and the corresponding time intervals between adjacent discharges are compared for each set of data to estimate a reliability of said correlation.

32. The lightning detection system of claim 31, wherein said correlation is accepted as reliable where at least one corresponding said time interval for all said sensors agree to within a predetermined maximum value.

33. A method for detecting lightning, comprising:

producing in response to an electromagnetic field produced by a lightning discharge an electrical detection signal representative of said electromagnetic field;

producing a digital detection signal representative of said electrical detection signal;

determining the type of lightning discharge that produced said electromagnetic field based on characteristics of said digital detection signal and producing digital data characterizing lightning discharges that are so determined;

reducing the amount of data needed to characterize a lightning discharge so as to decrease the time or bandwidth required to transmit data representative of a series of lightning discharges; and

transmitting said characterizing data over a communications channel.

34. The method of claim 33, wherein said reducing step produces data representative of the amplitude and data representative of the time of occurrence of the largest amplitude discharge in said series of lightning discharges.

35. The method of claim 34, wherein said reducing step further produces, for one or more additional lightning discharges in said series of discharges, data representative of the time of

occurrence of each said additional discharge with respect to the time of occurrence of an adjacent discharge.

36. The method of claim 35, wherein said reducing step further produces, for said one or more additional discharges in said series of discharges, data representative of the relative amplitude of each said additional discharge with respect to the amplitude of said largest amplitude discharge.

37. The method of claim 36, wherein said reducing step further comprises synchronously decimating said characterizing data as needed to accommodate the bandwidth of said communications channel.

38. The method of claim 37, wherein said decimating step comprises determining whether the rate of electrical detection signals produced in response to said series of lightning discharges exceeds the data transmission capacity of said communications channel and, in that event, selecting for transmission only data representing those electrical detection signals that occur during a periodically occurring time frame of predetermined length.

39. The method of claim 33, further comprising synchronously decimating said characterizing data as needed to accommodate the bandwidth of said communications channel.

40. The method of claim 39, wherein said decimating step further comprises determining whether the rate of electrical detection signal produced in response to said series of lightning

discharges exceeds the data transmission capacity of said communications channel and, in that event, selecting for transmission only data representing those discharges that occur during a periodically occurring time frame of predetermined length.

41. The method of claim 33, further comprising providing a plurality of electrical detection signals representative of an electromagnetic field from a lightning discharge and, for each said electrical detection signal, producing a digital detection signal, determining the type of lightning discharge that produced said electromagnetic field based on characteristics of said digital detection signal, producing digital data characterizing lightning discharges that are so determined, reducing the amount of data needed to characterize a lightning discharge so as to decrease the time or bandwidth required to transmit data representative of a series of lightning discharges, transmitting said characterizing data over a communications channel to a central location, and at said central location receiving said characterizing data and correlating sets of data to determine the time and location of one or more discharges, each said set of data corresponding to a unique source and an associated sensor location.

42. The method of claim 41, wherein said sets of data are correlated in time.

43. The method of claim 42, wherein two distinct pairs of three said sets of data are operated on by a correlation operator, the time shift corresponding to the peak correlation value is taken to be the difference in propagation time from a given discharge to the respective sensors which serve as respective sources whose data is correlated, and the two propagation time differences thus found are used to estimate the location of a discharge.

44. The method of claim 43, wherein three said sets of data are first compared to identify the data corresponding to the highest amplitude discharge represented in each set, the time differences between two distinct pairs of said data representing the highest amplitude discharge is taken to be the difference in propagation time from the highest amplitude discharge to the respective sensors which serve as respective sources whose data is correlated, and the two propagation time differences thus found are used to estimate the location of the said highest amplitude discharge.

45. The method of claim 44, wherein said sets of data are shifted in the time domain so that data representing said highest amplitude discharge in each said set of data are coincident, and the corresponding time intervals between adjacent discharges are compared for each set of data to estimate the reliability of the correlation.

46. The method of claim 45, wherein the correlation is accepted as reliable where at least one corresponding said time interval from among all said sensors agrees to within a predetermined maximum value.

47. The method of claim 41, wherein when said characterizing data includes information about the angle relative to two sensors which serve as respective sources with respect to a discharge, the location of said discharge is initially determined from said angles.

48. The method of claim 47, wherein the arrival times of said electromagnetic field produced by said discharge whose location is determined by said angles at a plurality of sensors which

serve as respective sources are estimated from said location, said sets of data from said plurality of sensors which serve as respective sources are shifted in the time domain by relative differences in said arrival times, and the corresponding time intervals between adjacent discharges are compared for each set of data to estimate the reliability of the correlation value.

49. The method claim 48, wherein the correlation is accepted as reliable where at least one corresponding said time interval for all said sensors agree to within a predetermined maximum value.

50. A method for detecting lightning, comprising:

producing in response to an electromagnetic field produced by a lightning discharge, an electrical detection signal representative of said field;

producing a digital detection signal responsive to said electrical detection signal;

determining the type of lightning discharge that produced said electromagnetic field based on characteristics of said digital detection signal and producing digital data characterizing lightning discharges that are identified;

synchronously decimating said characterizing data to reduce the data for transmission; and

transmitting said decimated characterizing data over a communications channel.

51. The method of claim 50, wherein said data decimating step comprises determining whether the rate electrical detection signals produced in response to a series of lightning discharges exceeds the data transmission capacity of said communications channel and, in that

event, selecting for transmission only data representing those electrical detection signals that occur during a periodically occurring time frame of predetermined length.

52. A method for detecting lightning, comprising:

providing a plurality of sources of data representative of a series of lightning discharges; and

receiving said data representative of a series of lightning discharges at a central location; and

correlating sets of data representing a series of discharges from respective said sources to determine the time or location of one or more discharges.

53. The method of claim 52, wherein said sets of data are correlated in time.

54. The method of claim 53, wherein two distinct pairs of three said sets of data are operated on by a correlation operator, the time shift corresponding to the peak correlation value is taken to be the difference in propagation time from a given discharge to respective sensors which serve as respective sources whose data is correlated, and the two propagation time differences thus found are used to estimate the location of a discharge.

55. The method of claim 53, wherein three said sets of data are first examined to identify the data corresponding to the highest amplitude discharge represented in each set, the corresponding time differences between two distinct pairs of said data representing the highest amplitude discharge are taken to be the difference in propagation time from the highest amplitude discharge

to respective sensors which serve as respective sources whose data is correlated, and the two propagation time differences thus found are used to estimate said location of the said highest amplitude discharge.

56. The lightning detection system of claim 55, wherein said sets of data are shifted in time so that data representing said highest amplitude discharge in each said set of data are coincident, and the corresponding time intervals between adjacent discharges are compared for each set of data to estimate the reliability of the correlation.

57. The lightning detection system of claim 56, wherein the correlation is accepted as reliable where at least one corresponding said time interval for all said sources of data agrees to within a predetermined maximum value.

58. The method of claim 52, wherein when said data include information about the angles relative to the location of two said data sources with respect to a discharge, the location of said discharge is initially determined from said angles.

59. The method of claim 58, wherein the arrival times of said electromagnetic field produced by discharge whose location is determined by said angles at said two said data sources are estimated from said location, said sets of data from said plurality of data sources are shifted in the time domain by relative differences in said arrival times, and the corresponding time intervals between adjacent discharges are compared for each set of data to estimate a reliability of said correlation.

60. The method of claim 59, wherein the correlation is accepted as reliable where at least one corresponding said time interval for all said data sources agrees to within a predetermined maximum value.